

Synthesis and properties of electrodeposited Ni –ceria–titania–CNT composite coating

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Electrodeposited Ni-composite coatings have been widely investigated due to their improved mechanical, wear and corrosion resistant properties over plain nickel coatings. In the literature, a large number of ceramic particles like SiC, Al₂O₃, TiO₂, CeO₂, ZrO₂ etc. have been incorporated in the nickel matrix and their properties have been explored. There are seldom any reports on the properties of electrodeposited Ni- CeO₂-TiO₂ composite coating. In the present work, to bestow the synergistic properties of both titania and ceria particles to the electrodeposited nickel matrix, a composite powder of titania-ceria was synthesized and used as the dispersing phase. The effect of applied current density on the properties of the coatings was also studied. Attempts were also made to study the effect of carbon nanotubes (CNT) on the properties of the Ni-ceria-titania composite coatings. Irrespective of the current density used for electrodeposition, higher microhardness values were obtained for the coatings electrodeposited at lower current density and from a bath with higher particle loading. Similarly, higher corrosion resistance was exhibited by the coatings electrodeposited at lower current density. The incorporation of CNT in the nickel matrix along with ceria-titania composite powder increased the roughness and decreased the microhardness, wear and corrosion resistances of the coatings. However, the coefficient of friction of the coatings decreased with the incorporation of CNTs. The coatings were also characterized by X-ray diffractometry, Raman spectroscopy and field emission scanning electron microscopy. This study clearly shows that ceria-titania is a promising candidate material which can be used as a reinforcement phase in metal matrix composites for increasing the microhardness, wear and corrosion resistances of the coatings.

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